VENEZUELAN MACRONYSSIDAE (ACARINA: MESOSTIGMATA)

by

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INTRODUCTION

Mites of the family Macronyssidae are primarily ectoparasites of rodents, marsupials, bats, and birds. Some species are of medical importance because they attack man in the absence of their natural hosts. Some are known to harbor or transmit causative agents of several zoonotic diseases such as murine typhus (Worth and Rickard, 1951), rickettsial pox (Philip and Hughes, 1948; and Strandtmann and Wharton, 1958), eastern equine encephalitis (Clark, Lutz, and Fadness, 1966), and coxsackie virus disease (Schwab, Allen, and Sulkin, 1952). Not only are some species of mites involved directly in the transmission of disease agents to man but they may play an important role in maintenance cycles of arthropod-borne zoonoses as well. One species is a proven vector of the virus *Ornithosis bedsoniae* (Eddie, Meyer, Lambrecht, and Furman, 1962) and another of the filarial worm *Litomosoides carinii* (Williams and Brown, 1946). Yunker (1964 and 1973) reviewed the importance of parasitic mites associated with laboratory animals and indicated the species, some of them macronyssids, which are potentially dangerous to man. Although macronyssid mites are known vectors of some disease causing agents, previous studies, for the most part, have been restricted to taxonomic discussions on the generic level (Till and Evans, 1964) or specific host groups (Radovsky, 1967).

The results of a survey of macronyssid mites of vertebrates, collected by the Smithsonian Venezuelan Project (SVP), are presented in this paper. There has been no previous comprehensive study of the macronyssid mites of Venezuela. Collecting was conducted by field teams under the direction of Norman E. Peterson, M. D. Tuttle, and A. L. Tuttle between July 1965 and September 1968. Hosts were collected throughout Venezuela and a variety of habitats were sampled.

Of the more than 5,000 specimens of macronyssid mites that were collected, the majority will be deposited in the Smithsonian Institution, Washington D.C., but representatives of all taxa will be deposited at the Universidad Central de Venezuela, Caracas.

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EVOLUTION OF THE MACRONYSSIDAE

For every advantage gained by a parasite in its relationship with a host there is a corresponding surrender of independence. Modifications in morphology and life cycles may be advantageous in one situation, *e.g.*, on a particular host, but may be disadvantageous in another. The morphology of a host, its mode of life, *e.g.*, whether it is sedentary or wide ranging, solitary or colonial, nomadic or tends to return to the same place to build a nest, as well as ambient conditions, are factors which affect the kinds of parasites a host may harbor. Other characteristics which affect host-parasite relationships are the host's ecological tolerance and whether it burrows in the ground or has no direct contact with the earth. In addition, the morphology of the parasite, its vagility and ecological tolerance, the number of offspring it produces, whether eggs or living young are produced, and whether all stages are obligate parasites or some stages are free-living are all influenced by host-parasite relationships.

Probably parasitism developed as a result of

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continued close association of predatory mites with potential vertebrate hosts. The abundance of necessary elements for survival afforded by a vertebrate host, *e.g.*, food and shelter, gradually replaced the less dependable survival elements associated with a predatory mode of life. With an increase in host specificity and development of intimate host-parasite relationships, adaptive morphological changes occurred in parasitic mites.

The transition from free-living to parasitic states can be observed by examining the existing mite faunas within various groups of parasitic mites. Free-living, predatory mites are characterized by heavy sclerotization and massive chelae. The closely related nest-dwelling facultative parasites, which are one step removed from free-living forms, generally have a less heavily sclerotized idiosoma and the chelae are somewhat smaller, as seen in many of the mites of the subfamily Laelapinae. At this juncture in the evolutionary process, true host specificity has not developed and a more appropriate term would be "nest specificity," as proposed by Wharton (1957). The host-parasite relationship at this point may be said to be generalized.

As host-parasite relationships become more intimate and specificity increases, changes in the morphology of parasitic mites occur which allow them to benefit from specific characteristics of the host. The first and more conspicuous changes often involve reduction in sclerotization of the idiosoma and a decrease in the number of setae. Also, as the parasites become more specialized, the mouthparts become better fitted for piercing and sucking, thus aiding in the blood-feeding process; they may also be modified for attachment to prevent removal when the host moves or preens. There are changes in body structure that aid the mite in either adhering to its host or moving rapidly through the pelage or plumage, *e.g.*, flattening of the body, unidirectional orientation of the setae, development of caudally directed spines and spurs on the coxae, and large tarsal claws. In some instances, parasites with very intimate host-parasite relationships have developed morphological characteristics which almost entirely limit their existence to one host or a closely related group of hosts. Such characteristics as size and strength of tarsal claws, number and size of setae, and relative length of legs may all change as dependence on the host increases. These adaptive features become apparent when families of parasitic mesostigmatid mites are compared. As mentioned earlier, the more generalized parasites (*e.g.*, most of the Laelapinae) have heavy sclerotization and generally a full complement of setae. The more specialized forms (*e.g.*, the Macronyssidae) tend to have less heavily sclerotized bodies and a general reduction in setation.

The Macronyssidae apparently are derived from the Laelapidae. The macronyssid genera retaining the most characteristics indicating a laelapine origin are *Ichoronyssus, Bewsiella,* and *Synasponyssus,* which are found on bats (Radovsky and Furman, 1969) and which are similar to the laelapid bat parasites *Neolaelaps* and *Notolaelaps.* Apparently this group of genera forms the stem from which the remainder of the family Macronyssidae evolved. Important facts that give credence to this hypothesis are that the laelapid bat parasites are restricted to bats of the primitive suborder Megachiroptera, while the Macronyssidae are restricted to the more recent Microchiroptera. These facts have led to the conclusion that the Macronyssidae first evolved and radiated on bats and secondarily acquired other hosts (Radovsky, 1969). Supporting evidence is provided by the host relationships of the two subfamilies of Macronyssidae. The more primitive Macronyssinae, which are found almost exclusively on bats, exhibit the greatest morphological diversity and the greatest degree of host specificity, indications of long association with particular hosts. The Ornithonyssinae, on the other hand, have a low degree of host specificity and many species of this subfamily have nonchiropteran hosts. Furthermore, they are more uniform morphologically, and probably biologically, and there are more species, all indications of recent evolution.

The Macronyssidae appear to have gone through several phases of adaptive radiation, some of which have taken place largely or entirely in the Neotropics. That the Neotropics are particularly rich in the number of macronyssid species is demonstrated by the species diversity in Venezuela. One phase involved macronyssine evolution on bats, apparently beginning at an early stage in the history of the Neotropical chiropteran fauna. Several endemic genera arose, including *Parichoronyssus, Radfordiella,* and *Macronyssoides,* particularly on bats of the superfamily Phyllostomoidea. Even though phyllostomoid bats were apparently the hosts during early radiation, there has been considerable movement to other bat host groups. *Radfordiella* and *Macronyssoides* are still essentially restricted to phyllostomoid hosts, while *Parichoronyssus* has become widespread within the Phyllostomoidea and some species even occur on emballonurid bats.

A second phase of radiation involved the ornithonyssines, which were perhaps late arrivals from the North (Radovsky, 1974). This phase produced the genera *Ornithyonyssus*, *Pellonyssus*, and *Draconyssus*, which are not associated with bats, as well as bat parasites, including *Chiroptonyssus*, which is endemic to the New World. Although there is strong evidence that *Ornithonyssus* was restricted to the New World in pre-Columbian times, three species of this genus have become extremely widespread, essentially cosmopolitan, (*O. bacoti* on rodents and *O. bursa* and *O. sylviarum* on birds). The spread of these species apparently was facilitated by their adaptability to house rats (*O. bacoti*) and domestic fowl (*O. bursa* and *O. sylviarum*) that were disseminated as a result of movement of human beings from one area to another. After this dissemination, the mites became permanently established in the Old World by transfer to native species of rodents and birds. Thus, a particularly low level of host specificity, in combination with human activity, has enabled these mites to achieve a remarkably wide geographic distribution. Other parasitic mites, such as *Laelaps nuttalli*, associated with house rats, are less adaptable to establishment on native hosts, possibly due to competition with other species of mites or less adaptability to ambient variations. Thus, they have narrower geographic distributions than *O. bacoti*.

"Mesostigmatic parasites have evolved principally towards simplification of the life cycle: that is, the number of separate stages and the number of active stages may each be reduced." (Radovsky, 1969:468). The tendency toward simplification is influenced by the trophic advantages of parasitism. Also, the chance that mites in inactive stages may be lost from the host results in increased pressure toward intrauterine development of early stages. Such is the case in the Spinturnicidae, which are host-specific and spend their entire life cycle on the host.

In the Macronyssidae, the larval and deutonymphal stages are quiescent and nonfeeding and generally are found on a substrate off the host. This adaptive modus contrasts with the permanently parasitic Spinturnicidae but is nonetheless associated with a high level of specialization for successful parasitism. The short duration of the larval and deutonymphal stages of Macronyssidae compensates for their relative defenselessness. Typically, but with a number of exceptions, unembryonated eggs are deposited on surfaces of the roost or nest of the host animal. The protonymph, unlike the larva, is active and searches out a host. After feeding to repletion, the protonymph molts into a deutonymph which is able to molt to the adult stage without further feeding. The need for only a single feeding period prior to adulthood, with resulting greater chance of reaching maturity, relates to a morphological and functional divergence between protonymphs and adults in the Macronyssidae.

The protonymph remains attached and feeds for a period of days, developing a new cuticle that greatly increases its capacity for engorgement. In contrast, the adults are rapid feeders. The factor of attachment may also enhance dissemination of this group of mites, as the protonymphs may be carried considerable distances by the host to a secondary nesting or roosting site before the protonymph completes engorgement and drops off the host. This may account for some of the atypical hosts seen in the Venezuelan records, particularly among bats which frequently roost in colonies in which several species of bats are represented. Since the adult mite must seek out a blood meal at the new location, the host it finds may not be the same host species that the protonymph fed upon.

It appears that the life cycles of macronyssid mites have been greatly affected by their host-parasite relationships. The prototype mite of the family Macronyssidae was probably a bat parasite, as most of the species of the family are now bat parasites and their life histories are consistent with that which would be expected from a long association of parasites with a highly vagile group of hosts. Bats which live in colonies afford greater security, as far as availability of a blood meal is concerned, than do potential hosts which are solitary. Even though development of some stages of the parasite occurs off the host, the problems of host finding are minimized when hosts occur in large colonies.

Among the Macronyssidae it appears that species of the subfamily Macronyssinae have had the longest association with bats, and it is within this group that the earliest radiation took place. The oldest members of the subfamily Ornithonyssinae were probably parasites of bats, but some species of the subfamily later acquired nonchiropteran hosts secondarily as a result of early radiation (Radovsky, 1969). It is probable that species which have been associated with their hosts for the longest period of time (*i.e.*, Macronyssinae) exhibit the greatest degree of host specificity, while those macronyssid species which have acquired nonchiropteran hosts in more recent times (*i.e.*, Ornithonyssinae) have broader host tolerances and low host specificity.

Family Macronyssidae

The concept of the family Macronyssidae in this paper is essentially the same as that proposed by Radovsky in his monograph on laelapid and macronyssid mites parasitic on bats (1967), and later expanded to include other parasitic Mesostigmata (1969). Radovsky recognized two subfamilies: Macronyssinae, primarily on bats, and Ornithonyssinae, on bats, rodents, marsupials, birds, and reptiles.

The 13 genera included in the Macronyssinae are: *Acanthonyssus, Argitis, Bewsiella, Chiroecetes, Ichoronyssus, Liponysella, Macronyssoides, Macronyssus, Megistonyssus, Nycteronyssus, Parichoronyssus, Radfordiella,* and *Synasponyssus.* The 8 genera included in the Ornithonyssinae are: *Chiroptonyssus, Cryptonyssus, Draconyssus, Lepidodorsum, Lepronyssoides, Ornithonyssus, Pellonyssus,* and *Steatonyssus.* Fifteen of these, plus one unnamed genus, have been identified among the material collected by the Smithsonian Venezuelan Project. Ten of these genera are discussed in the following accounts. They are listed alphabetically under the appropriate subfamily heading. The genera *Cryptonyssus* and *Pellonyssus* are each represented in the SVP collection by only 1 or 2 specimens, and these could not be identified to species. The genera *Macronyssus, Parichoronyssus, Steatonyssus,* and new genus N are being treated by other workers at present and thus are included only in the key and in the host-parasite list. A summary of the SVP macronyssid material can be found in the host-parasite list following the taxonomic accounts. Not represented in the SVP collections are the genera *Bewsiella, Ichoronyssus, Liponysella,* and *Megistonyssus,* found only in the Old World, and the genera *Lepronyssoides* and *Synasponyssus,* reported from the New World but not recorded from Venezuela.

Key to the Genera of Macronyssidae in Venezuela

(Females)

1. Chelicerae with second segment elongate, stylet-like; parasitic on reptiles ... *Draconyssus*
   Chelicerae with second segment normal, not elongate; parasitic on birds or mammals 2
2. Dorsal plate divided; palpal trochanter usually with blade-like ventral process ... 3
   Dorsal plate entire; process of palpal trochanter variable ... 4
3. Sternal plate about twice as wide as long, with strongly sclerotized posterior margin; sternal seta I about as large as sternal seta II; parasitic on bats ... *Steatonyssus*
   Sternal plate very narrow, arched, lacking sclerotized posterior margin; sternal seta I much smaller than sternal seta II; parasitic on birds ... *Pellonyssus*
4. Coxae I-III all with one or two heavy ventral spurs, some of which may be setigerous; genua and tibiae II-IV with proximally recurved ventral spurs ... 5
   Coxae I-III variable (coxae II-III may have nonsetigerous spurs); genua and tibiae II-IV without ventral spurs ... 6
5. Dorsal plate with clusters of punctae at bases of setae giving grapelike appearance; peritreme short and stout; parasitic on *Oryzomys* spp. ... *Argitis*
   Dorsal plate not as above; peritreme long and slender; parasitic on *Proechimys* spp. ... *Acanthonyssus*
6. Some idiosomal setae (especially caudal ones) barbed ... 7
   All setae bare ... 9
7. Sternal plate with only 2 pairs of setae; parasitic on *Oryzomys albigularis* ... *Lepidodorsum*
   Sternal plate normally with 3 pairs of setae; parasitic on various mammals and birds ... 8
8. Spur on palpal trochanter small or absent; caudal setae peglike, with multiple barbs; parasitic on bats ... *Chiroptonyssus*
   Spur on palpal trochanter bladelike; all setae slender and generally with only 1 barb; parasitic on birds and mammals ... *Ornithonyssus*
9. Dorsal setae minute; coxae II-III with ventral spurs; parasitic on *Lonchophylla robusta* ... *Chiroecetes*
   Dorsal setae not minute; coxae generally without ventral spurs, but sometimes ridged 10

10. Third pair of sternal pores on posterior margin of sternal plate; all legs stout, laelapoid in appearance; parasitic on bats .... *Parichoronyssus*
Third pair of sternal pores on unarmed integument; legs generally slender, not stout 11

11. Leg I stouter than legs II-IV, and claws arise directly from tarsus (no pretarsus); coxae II and III with small inapparent ridges; parasitic on *Desmodus youngi* .... *Nycteronyssus*
Leg I similar to legs II-IV, and claws arise from pretarsus; coxae II and III frequently with definite ventral ridges 12

12. Linear sculpturing entirely absent from ventral armature; anterior margin of coxa II with 2 small separate spurs or single spur with bifid tip; parasitic on bats ...... *Radfordiella*
Linear sculpturing present on one or more ventral plates; anterior margin of coxa II with single spur, rarely with bifid tip 13

13. Last pair of sternal setae on narrow extension of sternal plate; numerous setae on ventral surface; parasitic on bats of genera *Noctilio* and *Molossus* .... n. gen. "N"
Last pair of sternal setae on posterior portion of plate (which lacks narrow extension); ventral surface with few setae 14

14. Sternal glands present; fixed chela with 2 hook-like ventral hyaline processes; parasitic on bats .... *Macronyssus*
Sternal glands absent; fixed chela not as above 15

15. Ventral ridges usually present on coxae II-IV; epigynial plate with narrow membranous projection of anterior margin extending beyond posterior margin of sternal plate; dorsal plate not strongly tapered, covering most of dorsum; parasitic on bats .... *Macronyssoides*
Ventral ridges absent from coxae; epigynial plate with anterior margin inapparent or short, broad, and inconspicuous; dorsal plate strongly tapered, leaving much of dorsum uncovered; parasitic on bats .... *Cryptonyssus*

Subfamily Macronyssinae

This subfamily is found primarily on bats. It includes mites very diverse, both in form and in host-parasite relationships. The female chelicerae are uniform in diameter throughout their length, and the chelae are obvious. Both digits of the chelae are present and subequal. The male holoventral plate may be entire or divided, and the spermatodactyl is about twice the size of the movable digit. The fixed digit of the male chelae is always present and generally is as long as the movable digit.

Genus *Acanthonyssus* Yunker and Radovsky

Acanthonyssus Yunker and Radovsky, 1966:92; Yunker and Saunders, 1973:371 (Redefined).

Type Species: *Ichoronyssus dentipes* Strandtmann and Eads, 1947.

Small mites (adult less than 500 μ long); idiosomal setae relatively short, bare except for M_{11} of nymphs; adult dorsal plate entire, broadly rounded posteriorly. All coxae (active stages) with 1 or 2 stout ventral spurs, some bifid and setigerous; coxa II with large, sharp anterodorsal spur; telofemora III and IV, genua, and tibiae II-IV with strong, proximally recurved ventral spurs; tarsi II-IV each with pair of small setigerous spurs; palpal apotele two-tined; chelicerae slender and elongate.

Acanthonyssus proechimys Yunker and Saunders

Acanthonyssus proechimys Yunker and Saunders, 1973:371.

VENEZUELAN RECORDS (447 females, 234 males, and 46 nymphs):

Four hundred twenty-six females, 222 males, and 40 nymphs ex 118 *Proechimys semispinosus* were collected in the following states, listed in order from greatest to least number of collections: Zulia, Apure, Barinas, Carabobo, T. F. Amazonas, Sucre, Lara, Falcón, and Trujillo; 12 females, 11 males, and 4 nymphs ex 10 *P. guyannensis*, from T. F. Amazonas and Bolívar. There were also 9 females, 1 male, and 2 nymphs off *Heteromys anomalus*, *Sigmodon hispidus*, *Zygodontomys brevicauda*, *Rattus rattus*, *Sciurus granatensis*, and *Monodelphis brevicaudata*. Some of these hosts, particularly the nonrodent host, are presumed to be accidental. Infested hosts were found at elevations from 24-1355 m, but most were collected at low elevations.

REMARKS

A. proechimys is similar to *A. dentipes* (Strandtmann and Eads) but can be distinguished on the basis of the length-width ratio of the sternal plate (longer in *A. proechimys;* first pair of sternal setae do not reach the posterior margin of plate), length of the anal plate (shorter in *A. proechimys*) and length of the peritreme (extends only to middle of coxa I in *A. proechimys*) (Yunker and Saunders, 1973). In addition to morphological differences, there is a definite difference in host preference. *A. proechimys* is associated primarily with species of *Proechimys* while *A. dentipes* is most frequently associated with *Sigmodon hispidus*.

Variations in the dimensions of the dorsal plate of the female and idiosomal chaetotaxy of the male were noted in the material examined. In some females the dorsal plate was considerably shorter than that of the holotype, while in others the plate was narrower but just as long as that of the holotype. Major variations in the male were in the number of setae on the dorsal plate (24-26 pairs) and on the holoventral plate (due to asymmetrical erosion of the plate).

Genus *Argitis* Yunker and Saunders

Argitis Yunker and Saunders, 1973:378.

Type Species: *Argitis oryzomys* Yunker and Saunders, 1973.

Small mites (adults less than 500 μ long); adult dorsal plate entire, ornamented with large punctae, forming grapelike clusters of cells at setal bases and near anterolateral margins; idiosomal setae short, bare; peritreme wide and short, terminating at level of coxa III. All coxae with short ventral spurs, some of them setigerous, bifid or truncated. Genua and tibiae II-IV each bear long, robust, proximally recurved ventral spurs. Tarsi II-IV each with pair of small recurved setigerous spurs.

Argitis oryzomys Yunker and Saunders

Argitis oryzomys Yunker and Saunders, 1973:379.

VENEZUELAN RECORDS (9 females and 3 males):

Nine females and 2 males ex *Oryzomys concolor* (SVP 12750), Bolívar, 44 km ESE Caicara (Hato La Florida), 43 m, 15.IV.67; and 1 male ex *O. bicolor* (SVP 13451), Sucre, 9 km NE Güiria, 4 m, 14.VI.67.

REMARKS

Argitis shares many macronyssid characters with and is similar to *Acanthonyssus*. It can be distinguished from *Acanthonyssus* by the grapelike clusters of cells on the dorsal plate.

Argitis oryzomys was one of the least commonly collected mites in Venezuela, but careful examination of *Oryzomys* may result in extension of the known distribution of this species. The above collections (only known specimens of this species) were taken at widely separated localities.

Genus *Chiroecetes* Herrin and Radovsky

Chiroecetes Herrin and Radovsky, 1974:347.

Type Species: *Chiroecetes lonchophylla* Herrin and Radovsky, 1974.

Idiosomal armature reduced and lacking sculpturing. Dorsal plate with prominent anterolateral shoulders, narrowing medially, and ending in bluntly pointed tip; with 21 pairs of minute setae. Peritreme with posterior portion near stigma septate; peritremal plate not connected to any other plates. Sternal plate about as long as wide, with irregular anterior and emarginate lateral margins; with only 2 pairs of setae and 1 pair of pores. Epigynial plate long and narrow with bluntly pointed posterior tip; genital setae marginal. Opisthosomal setae slender and not barbed, those near anal plate on venter acuminate with inflated base. Legs moderately long; claws stout and subequal; some hypotrichy present. Anteromarginal spur of coxa II absent; coxae II and III each bearing well developed, blunt, ventral spur. Palpal trochanter with small, spurlike process; apotele two tined. Chelicerae rather short and stout.

Chiroecetes lonchophylla Herrin and Radovsky

Chiroecetes lonchophylla Herrin and Radovsky, 1974:348.

VENEZUELAN RECORD (1 female):

The single specimen was taken off a long-tongued bat, *Lonchophylla robusta* (SVP 22129), Zulia, 21 km SW Machiques (near Kasmera), 270 m, 17.IV.68.

REMARKS

This genus appears to be closest to the *Radfordiella*, *Parichoronyssus* and *Macronyssoides* group of the Macronyssinae (Herrin and Radovsky, 1974). It has most features in common with *Radfordiella*.

Genus Macronyssoides Radovsky

Macronyssoides Radovsky, 1966:96; 1967:166.

Type Species: *Ichoronyssus kochi* Fonseca, 1948.

"Dorsal plate of female with 24 to 27 setal pairs; S8 absent. Sternal plate without sternal glands (but one species with fine punctae in an area delimited by sculptured lines, posteromedial to first pair of sternal pores). Epigynial plate strongly tapered, with pointed or very narrowly rounded tip; anterior margin with long median projection; without scalelike anterior sculpturing. Coxae II to IV of adults with or without distinct ventral ridges, (present in described species; absent in some unassigned material). Female chelae simple, without spinelike processes; tip of fixed chela with expanded hyaline margin. Palpal trochanter of female with distally arising bladelike process; palpal process absent in male. Protonymph with pygidial plate bearing 4 setal pairs; S8 absent. Leg I of protonymph stouter than other legs, with stronger claws; coxa I usually with strong ventral ridge (present in all described species, but ridge lacking in some unassigned material)." (Radovsky, 1967:166)

Remarks

Macronyssoides resembles the genus *Macronyssus* but can be distinguished by the absence of sternal glands in the female, by the presence of a bladelike process on the palpal trochanter, and by a strongly tapering, pointed epigynial plate. Protonymphs of the two genera differ in that *Macronyssoides* has 11 setal pairs on the podosomal plate (10 in *Macronyssus*), four setal pairs on the pygidial plate (5-7 pairs in *Macronyssus*), and the process on the palpal trochanter is bladelike as in the female (ridgelike in *Macronyssus*). Males of *Macronyssoides* lack the palpal process. Only the male of *M. kochi* has been described.

Macronyssoides conciliatus Radovsky

Macronyssoides conciliatus Radovsky, 1967:169.

Venezuelan Records (20 females and 114 protonymphs):

Eight females and 57 protonymphs ex 16 *Vampyrops umbratus;* 7 females and 37 protonymphs ex 7 *V. aurarius*. The remaining specimens were collected from 4 other species of bats, 2 birds, a shrew (*Cryptotis thomasi*), and a rat (*Rattus rattus*). Mites collected from hosts other than bats probably represent contamination. Associations of mites with bats other than species of Vampyrops may be the result of several species of bats sharing the same roosting areas and are considered accidental.

Remarks

The type series of this species was collected in Panama off *Vampyrops vittatus*. These Venezuelan collections represent the only other published records of *M. conciliatus*. Species of *Vampyrops* appear to be the natural hosts. Most specimens were collected at elevations above 1000 meters. States or districts in which collections were made, in order of diminishing number of collections, are: Dto. Federal, Bolívar, Miranda, Barinas, Mérida, Yaracuy, and Carabobo.

Macronyssoides kochi (Fonseca)

Ichoronyssus kochi Fonseca, 1948:278.

Macronyssoides kochi Radovsky, 1966:94; 1967: 167; Dusbabek, 1969:321.

Venezuelan Records (105 females, 1 male, and 316 protonymphs):

Twelve females, 1 male, and 252 protonymphs ex 80 *Artibeus jamaicensis;* 57 females and 13 protonymphs ex 8 *Artibeus lituratus;* 19 females and 10 protonymphs ex 9 *Vampyrops helleri*; 7 protonymphs ex 6 *Carollia perspecillata;* and 1 female and 13 protonymphs ex 1 *Desmodus rotundus*. The remaining 37 specimens were collected from various species of bats of the families Emballonuridae, Mormoopidae, and Phyllostomidae, and from a marsupial. The latter record is probably an error, and most of the miscellaneous bat hosts are considered to be accidental host-parasite associations.

Remarks

M. kochi was collected throughout Venezuela. However, most of the collections came from the northwestern portion of the country, particularly from Zulia and Trujillo. There were also numerous collections from Bolivar and T. F. Amazonas. Some collections were made at an elevation of 1810 m but the majority of specimens came from between 100 and 200 meters.

The only male collected in Venezuela differs somewhat from the description given by Radovsky (1967:168), but the females and protonymphs from the same collection fit his description. For this reason, I have tentatively assigned this specimen to *M. kochi* awaiting additional material or further study.

Genus *Nycteronyssus* Saunders and Yunker

Nycteronyssus Saunders and Yunker, 1973:381.

Type Species: *Nycteronyssus desmodus* Saunders and Yunker, 1973.

Large mites (adult over 600 μ long). Dorsal plate entire but rather small, with 20 pairs of setae (F_1 pair very small and remainder robust, bare, spiniform). Peritremal plate long, connecting with dorsal plate anteriorly; peritreme short, wide, terminating over coxa III. Sternal plate wider than long, lateral margins slightly concave, with three pairs of setae. Epigynial plate well removed from sternal plate, short, narrow, linguiform, and with single pair of setae. Leg I short and robust, its claws massive and arising directly from tarsus; legs II-IV normal.

Nycteronyssus desmodus Saunders and Yunker

Nycteronyssus desmodus Saunders and Yunker, 1973:382.

Venezuelan Record (1 female):

The single female from which this species was described was taken from a vampire bat, *Desmodus youngi* (SVP 26680), T. F. Amazonas, 163 km ESE Pto. Ayacucho (San Juan, Rio Manapiare), 155 m, 14.VII.67.

Remarks

This is a unique species having characteristics of both ecto- and endoparasitic forms. Due to its host association and the majority of characteristics being typically macronyssid, it is assigned to the family Macronyssidae, subfamily Macronyssinae.

Genus *Radfordiella* Fonseca

Radfordiella Fonseca, 1948:270.

Type Species: *Radfordiella oudemansi* Fonseca, 1948.

Small mites with moderately long, thick legs. Female dorsal plate abruptly narrowed posterior to setal pair M8; setal pair M11 subterminal; with 22-26 pairs of setae; setae SS absent. Ventral plates without sculpturing and sternal glands absent. Coxae without ventral ridges or with weak ridges on coxae II and III or II-IV. Coxa II with bifid anterior spur or two separate anterior spurs. Palpal trochanter of female with bladelike process; that of male with weak ridge or lacking process. Protonymph with 3 or 4 pairs of setae on pygidial plate.

Remarks

In lieu of a separate discussion for each of the five or more species of this genus found in Venezuela, the following comments and discussion contributed by Dr. Frank J. Radovsky (1974), the authority on this genus, are provided:

"The genus *Radfordiella* is an important element among the mites parasitic on Neotropical bats, yet only one species was named prior to 1967. That the extensiveness of this faunal element is only now beginning to be appreciated relates to the limited amount of work on acarine parasites in the Neotropics and to the relatively small size of these compared to other macronyssids. Nonetheless, it is difficult to account for the late discovery of *Radfordiella desmodi*, a regular and abundant parasite of the common vampire bat, *Desmodus rotundus*.

"Radovsky, *et al.* (1971), recognized 6 species of Radfordiella in reviewing that genus in relation to describing 3 new species with protonymphs parasitic in the mouths of glossophagine bats (only the protonymphs of these 3 species are known). All species appear to have Phyllostomoidea as maintaining hosts.

"The analysis of the collections of Radfordiella from Venezuela is still in progress, but the findings can be summarized. Most of the collections are of the 3 species previously known from adults as well as protonymphs: *R. oudemansi* Fonseca, 1948; *R. desmodi* Radovsky, 1967; and *R. carolliae* Radovsky, 1967. The greatest number of collections were *R. desmodi*, involving approximately 100 individual hosts, of which more than 85 percent were *Desmodus rotundus*. The other hosts recorded for *R. desmodi* were largely phyllostomid bats, in most cases with only a single specimen of the mite collected. Two records from birds, coincident with collections from *D. rotundus*, need to be verified. The resulting picture is one of a high degree of species specificity, bearing out previous observations on this mite, especially where numerous collections have been made in Panama and Trinidad. The closely related species *R. carolliae* appears to be specific at the generic level, *i.e.*, on bats of the genus *Carollia*. These results also tend to confirm the specific distinctness of this mite from *R. desmodi*. *R. oudemansi* was found on at least 7 genera of phyllostomoid bats, confirming earlier observations that suggested a lower level of specificity for this mite.

"In addition to the known species noted above, at least 2 undescribed species of *Radfordiella* have been distinguished thus far in the Venezuelan collections. These are from the bats *Peropteryx* and *Lionycteris*, and both are related to the *desmodi-carolliae* species group. Other mites represented by single or a few specimens are possibly new but require further study; they are from such phyllostomid hosts as *Tonatia*, *Sturnira*, *Phylloderma*, and *Lonchorhina*. Each of these mites of questionable specific status is obviously related either to the *desmodi-carolliae* group or to the *oudemansi* group.

"In summary, the Venezuelan collections of *Radfordiella* support this as being a genus of major importance and of which only a relatively small fraction of the existing species are probably known at present. The genus apparently originated as parasites of Phyllostomoidea and has evolved to some extent with this host group. Therefore, the genus may prove to be useful in analyzing the phylogenetic relationships of their hosts. There is a wide range of levels of specificity in the genus from host species to host superfamily. The host-parasite relationships are scarcely studied, with most information relating to the occurrence of protonymphs of certain species in specific loci in the mouth of long-nosed, nectar- and pollen-feeding bats, and offer an intriguing area for future investigation."

Subfamily Ornithonyssinae

These mites represent the most successful outgrowth of earlier radiation in the Macronyssidae. All are haematophagus with a considerable capacity for engorgement. They are more uniform morphologically and probably biologically than the Macronyssinae, but they are also more numerous and are found on a greater variety of hosts, including reptiles, birds, and mammals (both bats and nonaerial forms). Adult females lack sternal glands and frequently setal pair D7 is lacking on adult dorsal armature. The epigynial plate generally is narrowly rounded or pointed. The female palpal trochanter has a bladelike process and the dorsal setae generally are slender and barbed.

Genus *Chiroptonyssus* Augustson

Chiroptonyssus Augustson, 1945:46; Radovsky, 1967:176.

Type Species: *Chiroptonyssus texensis* Augustson, 1945. (=*Liponyssus robustipes* Ewing, 1925).

Caudal setae short and stout, with 2 rows of barbs. Dorsal plate entire, with 30-36 pairs of setae. Palpal trochanter with spurlike ridge. Leg II stouter than leg I; coxa II with anterior marginal spur. Sternal plate rectangular, with or without posterior lateral extensions. Epigynial plate faintly sculptured, tapering to narrow point.

Remarks

For a more detailed description and notes on synonomy of this genus see the excellent review of macronyssid and laelapid parasites of bats by Radovsky (1967:176).

Chiroptonyssus haematophagus (Fonseca)

Liponissus (sic) *haematophagus* Fonseca, 1935a: 25

Chiroptonyssus haematophagus Radovsky, 1966-94; 1967:181; Dusbabek, 1969:323.

Venezuelan Records (12 females, 1 male, and 381 protonymphs):

Nine females and 180 protonymphs ex 29 *Molossus ater;* 38 protonymphs ex 5 *M. bondae;* 1 female, 1 male, and 113 protonymphs ex 11 *M. molossus;* 10 protonymphs ex 3 *M. aztecus;* and 2 females and 1 protonymph ex 3 *Tadarida gracilis.* The remainder of the specimens occurred in groups of from 1 to 10 on 1 or 2 individuals of a variety of bats, rodents, and a marsupial. The latter two hosts are considered erroneous records or work table contaminations, as this species is strictly a bat parasite.

Remarks

This species has been known previously only from the type collection from Brazil and the following countries: Cuba, Mexico, Trinidad, and Panama (Dusbabek, 1969). It is here recorded for the first time from Venezuela. The specimens collected agree with the description given by Radovsky (1967) in his review of macronyssid and laelapid parasites of bats.

The dorsal plate of female *C. haematophagus* tapers to a blunt point and has 32 pairs of setae; there is a slight constriction between the main part of the sternal plate and the posterior sternal setae, but not as distinct as in *C. venezolanus.* The male has a stout, curved spur on trochanter IV. Such a spur is lacking in *C. robustipes* and on femur IV of *C. venezolanus.* Protonymphs of *C. haematophagus* have 5 pairs of setae on the unarmed venter, while those of *C. robustipes* have 7 pairs. Protonymphs of *C. robustipes* and *C. haematophagus* lack the blunt lateral spur on coxa I which is found in *C. venezolanus.*

The known host range of *C. haematophagus* is expanded with the addition of the following new hosts: *Molossus aztecus* and *M. bondae.*

Chiroptonyssus robustipes (Ewing)

Liponyssus robustipes Ewing, 1925:20.

Chiroptonyssus texensis Augustson, 1945:46.

Chiroptonyssus robustipes Fonseca, 1948:284.

Venezuelan Records (16 protonymphs):

Thirteen protonymphs ex 1 *Tadarida brasiliensis* (SVP 4009), Merida, 4 km E Tabay (La Mucuy), 2107 m, 8. III. 66; 1 protonymph ex *Tadarida brasiliensis* (SVP 4019), same data as above except 9.III.66; and 2 protonymphs ex *Sturnira ludovici* (SVP 4025), same data as above.

REMARKS

Chiroptonyssus robustipes is very similar to *C. haematophagus* but can be distinguished by the characteristics given in the remarks section under the latter species. *C. robustipes* was encountered infrequently in Venezuela on *Tadarida brasiliensis* and *Sturnira ludovici.* This latter record may be in error or due to contamination, as *C. robustipes* has been recorded previously from molossid bats only (primarily species of *Tadarida;* see Radovsky, 1967).

Chiroptonyssus venezolanus (Vitzthum)

Liponissus (sic) *venezolanus* Vitzthum, 1932:9.
Chiroptonyssus venezolanus Radovsky, 1966:94; 1967:182; Dusbabek, 1969:323.

VENEZUELAN RECORDS (13 females and 209 protonymphs):

Thirteen females and 203 protonymphs ex 48 *Tadarida gracilis;* 6 other protonymphs were from one collection each from a variety of bats and a rodent and may represent contaminations.

REMARKS

The above records represent an extension of the host range for this species. Radovsky (1967) pointed out that the greatest variation between type specimens and other specimens he examined was among specimens from *Tadarida femorosacca* in Arizona. The specimens from Venezuelan *Tadarida gracilis* agree well with the published descriptions of *C. venezolanus* and do not appear to represent any new or different taxa.

All but 13 of the specimens of *C. venezolanus* were collected in the southern portions of T. F. Amazonas and Apure at elevations ranging from 76-470 m. The majority were from around 200 m.

UNASSIGNED MATERIAL

Two specimens, a female ex *T. gracilis* and a protonymph ex *T. brasiliensis,* could not be placed with confidence in any presently known species of *Chiroptonyssus.* These specimens may be aberrant or could represent new species. In the absence of an adequate series of specimens in which females are represented, it is inadvisable to describe new taxa at this time or to assign these specimens to a known taxon.

Genus *Draconyssus* Yunker and Radovsky

Draconyssus Yunker and Radovsky, 1966:93.

Type Species: *Draconyssus belgicae* Yunker and Radovsky, 1966.

"With two dorsal shields or with a single prosomal shield and a cluster of pygidial platelets; second cheliceral segment extremely elongate, but not attenuate, at rest deeply withdrawn into idiosoma; sternal plate with two pairs of setae; metasternal setae absent; epigynial setae off plate; peritreme extending to level of middle of coxa II. Male unknown." (Yunker and Radovsky, 1966:93).

REMARKS

Draconyssus possesses morphological features which relate it to both the Dermanyssidae and the Macronyssidae: It has the long second cheliceral segment characteristic of dermanyssid mites, but the chelae are strong as in the macronyssid mites (rather than minute as in dermanyssid mites). Yunker and Radovsky (1966) remarked, "At this point we are unable to assign *Draconyssus* to a subfamily within the Dermanyssidae. We suspect it to be a macronyssid and to have affinities with *Ophionyssus* and *Sauronyssus.*" Therefore, I have included *Draconyssus* in this paper.

Draconyssus belgicae Yunker and Radovsky

Draconyssus belgicae Yunker and Radovsky, 1966:93.

VENEZUELAN RECORDS (3 females):

Three females ex 3 "lizards." Two of the 3 specimens were collected in Trujillo (90 m) and the other in Falcon (90 m).

REMARKS

Venezuelan specimens closely agree with the type material from Panama. Yunker and Radovsky (1966) reported considerable variation in features of the dorsal and ventral plates in the type material from Panama, but inasmuch as only 3 specimens were collected in Venezuela, there was no opportunity to study variation there. Had more attention been given to the collection of intranasal mites of lizards, it is probable that more specimens of *D. beligicae* would have been available for study.

Genus *Lepidodorsum* Saunders and Yunker

Lepidodorsum Saunders and Yunker, 1975:756-759.

Type Species: *Lepidodorsum tiptoni* Saunders and Yunker, 1975.

Macronyssid mites of moderate to small size (adult 500-600 μ long). Dorsal plate entire, elongate-ovate, ornamented with scale-like pattern forming small cells over most of plate (each cell, except those of plate margins, containing many small punctae). Dorsal plate with 15-17 pairs of barbed setae; unarmed integument hypertrichous. Sternal plate short, with only two pairs of sternal setae; St3 absent. Epigynial plate long, narrow, and with membranous anterior flap extending over sternal plate to base of tritosternum. Idiosomal setae of moderate length, some piliform, and most barbed. Peritreme long, narrow, terminating over coxa II; peritremal plate fused with dorsal plate anteriorly. All coxae with definite sculpturing but lacking ventral spurs or ridges. Legs normal, without any striking modification. Chelicerae slender, rather long; chelae simple, endendate, without setae. Palpal trochanter without ventral spur.

Male: Unknown.

Protonymph: Unknown.

Lepidodorsum tiptoni Saunders and Yunker

Lepidodorsum tiptoni Saunders and Yunker, 1975:756-759.

Venezuelan Records (23 females):

Of the 23 females collected, 22 were off 6 *Oryzomys albigularis*, the type host. The single remaining specimen, in poor condition, was off *Zygodontomys brevicauda*.

Remarks

This genus and species is similar to *Ornithonyssus* but differs from it in the following important aspects: (1) sternal setae 3 absent, (2) palpal trochanter without ventral spur, (3) anal plate enlarged, (4) epigynial plate with prolonged anterior projection, and (5) peritremal plate fused anteriorly with dorsal plate.

Genus *Ornithonyssus* Sambon

Ornithonyssus Sambon, 1928:105; Strandtmann and Wharton, 1958:81; Furman and Radovsky, 1963:90 (Rediagnosis).

Type Species: *Dermanyssus sylviarum* Canestrini and Fanzago, 1878.

All setae slender and many, particularly posterior ones, barbed (single barb usually). Dorsal plate generally entire, frequently leaving large area of idiosoma exposed. Legs moderately long and slender. Coxae without prominent ridges or spurs; anteromarginal spur of coxa II small.

Remarks

This genus was the most prevalent among the macronyssid mites collected in Venezuela, due primarily to the large numbers of *Ornithonyssus bacoti*.

Ornithonyssus bacoti (Hirst)

Leiognathus bacoti Hirst, 1913:122.

Ornithonyssus bacoti Bregetova, 1956:165; Strandtmann and Wharton, 1958:83; Strandtmann, 1956:137; Baker, *et al.*, 1956: 22.

Venezuelan Records (218 females, 222 males, 1243 protonymphs, and 1 larva):

Thirty-four females, 24 males, and 429 protonymphs ex 116 *Zygodontomys brevicauda;* 45 females, 54 males, and 226 protonymphs ex 100 *Sigmodon hispidus;* 50 females, 72 males, and 222 protonymphs ex 94 *Proechimys semispinosus*; 21 females, 13 males, and 101 protonymphs ex 26 *Sigmomys alstoni;* 18 females, 5 males, and 95 protonymphs ex 19 *Rattus rattus;* 1 female, 25 males, and 34 protonymphs ex 13 *Proechimys guyannensis.* Other hosts from which *O. bacoti* was collected included 9 *Holochilus brasiliensis*, 5 *Marmosa robinsoni*, and 5 *Monodelphis brevicaudata.* Mammals infested with this species 3 or 4 times were *Didelphis marsupialis, Echimys semivillosus, Rhipidomys macconnelli, Nectomys squamipes, oryzomys fulvescens,* and *Akodon urichi.* The remaining 33 species of rodents, bats, marsupials, and birds from which specimens were recorded may be work table contaminations or accidental infestations.

Remarks

The specimens of *O. bacoti* taken in Venezuela agree well with descriptions of the species. Yunker and Radovsky (1966) found *Sigmodon hispidus* to be a more common host of *O. bacoti* than *Zygodontomys brevicauda* in Panama, while the reverse was true in Venezuela, although both species were frequently infested.

The tropical rat mite is one of the most cosmopolitan of all parasitic mesostigmatid mites. It was first described from Egypt but has since been found worldwide in association with man and his domiciliated animals, particularly rodents. *O. bacoti* is found primarily on house rats, but is common on many other species of rodents, and can attack birds and many mammals other than rodents, including man.

Strandtmann and Wharton (1958) expressed the view that *O. bacoti* originated in the New World as a parasite of *Sigmodon hispidus* and secondarily became associated with species of *Rattus* on which it has spread throughout the world.

Ornithonyssus bursa (Berlese)

Leiognathus bursa Berlese, 1888:208.

Ornithonyssus bursa Sambon, 1928:107; Strandtmann and Wharton, 1958:86.

VENEZUELAN RECORDS (12 females, 1 male, and 6 protonymphs):

Eleven females, 1 male, and 6 protonymphs ex 2 "birds," 1 female ex *Desmodus rotundus*. The latter record is probably the result of work table contamination.

REMARKS

The fact that this species was taken from only three hosts in Venezuela probably does not reflect its prevalence but rather indicates that very few birds were sampled for ectoparasites.

Ornithonyssus wernecki (Fonseca)

Liponyssus wernecki Fonseca, 1935b:74.

Ornithonyssus wernecki Furman and Radovsky, 1963:91.

VENEZUELAN RECORDS (39 females, 20 males, and 16 nymphs):

Thirty-eight females, 20 males, and 7 nymphs ex 9 *Didelphis marsupialis;* 1 female and 9 nymphs ex 2 *Lutreolina crassicaudata*.

REMARKS

As noted by Strandtmann and Wharton (1958), *O. wernecki* is most commonly found on marsupial hosts. In the Venezuelan material, all collections were off marsupials. *O. wernecki* can be separated from *O. bacoti* by the presence of a spurlike elevation on coxa I, from which the proximal seta arises, and by its host associations. *O. bacoti* is found primarily on rodent hosts while *O. wernecki* is found on marsupials.

HOST-PARASITE LIST*

(Smithsonian Venezuelan Project Collection)

Class Reptilia

I. Order Squamata
   A. Family
      1. *Draconyssus belgicae* 3**

Class Aves

II. Order
   A. Family
      1. "Bird"
         a. *Ornithonyssus bursa* 2
         b. *Pellonyssus sp.* 2

Class Mammalia

III. Order Marsupialia
   A. Family Didelphidae
      1. Monodelphis brevicaudata
         a. *Ornithonyssus bacoti* 5
      2. *Marmosa robinsoni*
         a. *Ornithonyssus bacoti* 5
      3. *Didelphis marsupialis*
         a. *Ornithonyssus bacoti* 3
         b. *Ornithonyssus wernecki* 9
      4. *Lutreolina crassicaudata*
         a. *Ornithonyssus wernecki* 2

IV. Order Chiroptera
   A. Family Emballonuridae
      1. *Saccopteryx bilineata*
         a. *Parichoronyssus cryptosternum* 1
      2. *Peropteryx macrotis*
         a. *Radfordiella* n. sp., nr. *carolliae* 6
         b. *Radfordiella* sp. 1
   B. Family Noctilionidae
      1. *Noctilio labialis*
         a. *Macronyssus crosbyi* 1
         b. *Parichoronyssus euthysternum* 1
         c. *Parichoronyssus oudemansi* 1
         d. *Steatonyssus* sp. 1
         e. New Genus "N" n. sp. #1 2
         f. New Genus "N" n. sp. #2 2
   C. Family Phyllostomidae
      1. *Lonchorhina aurita*
         a. *Radfordiella oudemansi* 1
         b. *Radfordiella* sp. 1
      2. *Tonatia brasiliensis*
         a. *Radfordiella* sp. 1
      3. *Phyllostomus hastatus*
         a. *Radfordiella oudemansi* 2
         b. *Parichoronyssus* sp. 1
         c. *Parichoronyssus* n. sp., not *sclerus* 3
         d. *Parichoronyssus* n. sp. #1 6
      4. *Phylloderma stenops*
         a. *Macronyssus meridionalis* 1
         b. *Radfordiella oudemansi* 2
         c. *Radfordiella* n. sp., nr. *oudemansi* 1
      5. *Trachops cirrhosus*
         a. *Macronyssus meridionalis* 1

*An attempt has been made to eliminate those collections considered erroneous or accidental association.
**The number of hosts from which collections of each species of parasite were made

6. *Glossophaga soricina*
   a. *Macronyssoides kochi* 1
7. *Lionycteris spurrelli*
   a. *Parichoronyssus* n. sp., not *sclerus* 2
   b. *Radfordiella* n. sp. 6
8. *Lonchophylla robusta*
   a. *Chirocetes lonchophylla* 1
9. *Anoura geoffroyi*
   a. *Parichoronyssus* sp. 1
10. *Choeroniscus godmani*
   a. *Macronyssus* sp. 1
11. *Carollia perspicillata*
   a. *Chiroptonyssus haematophagus* 1
   b. *Macronyssoides kochi* 6
   c. *Parichoronyssus crassipes* 1
   d. *Parichoronyssus* n. sp., not *sclerus* 1
   e. *Radfordiella carolliae* 4
   f. *Radfordiella desmodi* 2
12. *Carollia brevicauda*
   a. *Parichoronyssus euthysternum* 1
   b. *Radfordiella carolliae* 2
13. *Carollia* sp.
   a. *Parichoronyssus euthysternum* 1
   b. *Parichoronyssus* sp., nr. *euthysternum* 1
   c. *Radfordiella carolliae* 5
   d. *Radfordiella* sp. 4
14. *Sturnira erythromos*
   a. *Macronyssoides* sp. 2
   b. *Macronyssus* sp. 1
15. *Sturnira lilium*
   a. *Chiroptonyssus haematophagus* 1
   b. *Macronyssus* n. sp. #1 1
   c. *Parichoronyssus euthysternum*
   d. *Parichoronyssus* sp., nr. *euthysternum* 3
   e. *Radfordiella* sp. 1
16. *Sturnira ludovici*
   a. *Chiroptonyssus robustipes* 1
   b. *Parichoronyssus euthysternum* 1
   c. *Parichoronyssus* sp. 2
17. *Uroderma bilobatum*
   a. *Macronyssoides kochi* 1
18. *Vampyrops aurarius*
   a. *Macronyssoides conciliatus* 7
   b. *Macronyssus* sp., nr., but not, *unidens* 1
19. *Vampyrops helleri*
   a. *Macronyssoides kochi* 9
   b. *Macronyssoides* sp. 1
   c. *Parichoronyssus* n. sp. #2 1
   d. *Radfordiella oudemansi* 1
20. *Vampyrops umbratus*
   a. *Macronyssoides conciliatus* 6
   b. *Macronyssoides kochi* 1
   c. *Parichoronyssus* sp., nr. *euthysternum* 1
21. *Artibeus cinereus*
   a. *Macronyssoides kochi* 2
22. *Artibeus* concolor
   a. *Parichornyssus* sp., near n. sp. #2 1
23. *Artibeus fuliginosus*
   a. *Macronyssoides kochi* 1
24. *Artibeus jamaicensis*
   a. *Macronyssoides kochi* 80
   b. *Chiroptonyssus venezolanus* 1
25. *Artibeus lituratus*
   a. *Macronyssoides kochi* 8
26. *Desmodus rotundus*
   a. *Chiroptonyssus venezolanus* 1
   b. *Macronyssoides kochi* 1
   c. *Macronyssus* n. sp. #1 5
   d. *Parichoronyssus* n. sp. #1 1
   e. *Parichoronyssus* n. sp., not *sclerus* 1
   f. *Radfordiella desmodi* 76
   g. *Radfordiella* sp. 1
27. *Desmodus youngi*
   a. *Radfordiella desmodi* 1
   b. *Radfordiella oudemansi* 6
   c. *Nycteronyssus desmodus* 1
28. *Desmodus sp.*
   a. *Radfordiella desmodi* 1

D. Family Vespertilionidae
1. *Myotis albescens*
   a. *Macronyssus crosbyi* 2
   b. *Macronyssus* sp. 2
   c. *Steatonyssus joaquimi* 1
2. *Myotis nigricans*
   a. *Chiroptonyssus venezolanus* 1
   b. *Macronyssus meridionalis* 9
   c. *Macronyssus* sp., nr. *crosbyi* 1
3. *Myotis* sp.
   a. *Macronyssus* sp., nr. *crosbyi* 1
4. *Eptesicus brasiliensis*
   a. *Macronyssus* sp., nr., but not, *sclerus* 13
   b. *Macronyssus* sp., nr. *crosbyi* 1
   c. *Macronyssus* sp., nr. *longisetosus* 1
   d. *Macronyssus* sp. 4
   e. *Steatonyssus* sp. 3

5. *Eptesicus fuscus*
    a. *Steatonyssus occidentalis* 1
6. *Eptesicus* sp.
    a. *Macronyssus* sp., nr., but not, *unidens* 1
    b. *Steatonyssus occidentalis* 1
    c. *Steatonyssus* sp. 3
7. *Histiotus* sp. A.
    a. *Cryptonyssus* sp. 1
8. *Lasiurus ega*
    a. *Steatonyssus radovskyi* 1

E. Family Molossidae
1. *Molossops planirostris*
    a. *Chiroptonyssus venezolanus* 1
2. *Tadarida brasiliensis*
    a. *Chiroptonyssus robustipes* 2
    b. *Chiroptonyssus* sp., not *robustipes* 1
3. *Tadarida gracilis*
    a. *Chiroptonyssus haematophagus* 3
    b. *Chiroptonyssus venezolanus* 48
    c. *Chiroptonyssus* sp. 1
4. *Molossus ater*
    a. *Chiroptonyssus haematophagus* 29
    b. *Parichoronyssus* n. sp. #1 1
    c. New Genus "N" n. sp. #2 15
5. *Molossus aztecus*
    a. *Chiroptonyssus haematophagus* 3
6. *Molossus bondae*
    a. *Chiroptonyssus haematophagus* 5
    b. New Genus "N" n. sp. #2 3
7. *Molossus molossus*
    a. *Chiroptonyssus haematophagus* 11
    b. New Genus "N" n. sp. #2 1
8. *Molossus sinaloae*
    a. *Chiroptonyssus haematophagus* 1
9. *Molossus* sp.
    a. *Chiroptonyssus haematophagus* 1
10. *Promops* sp.
    a. *Chiroptonyssus haematophagus* 1

V. Order Rodentia

A. Family Sciuridae
1. *Sciurus granatensis*
    a. *Acanthonyssus proechimys* 1

B. Family Heteromyidae
1. *Heteromys anomalus*
    a. *Acanthonyssus proechimys* 1

C. Family Muridae
1. *Oryzomys albigularis*
    a. *Lepidodorsum tiptoni* 6
2. *Oryzomys bicolor*
    a. *Argitis oryzomys* 1
3. *Oryzomys concolor*
    a. *Ornithonyssus* n. sp. 1
    b. *Ornithonyssus* sp., nr. *bacoti* 1
    c. *Argitis oryzomys* 1
4. *Oryzomys fulvescens*
    a. *Ornithonyssus* sp. 1
    b. *Ornithonyssus bacoti* 3
    c. *Ornithonyssus* n. sp. 3
5. *Oryzomys minutus*
    a. *Ornithonyssus* n. sp. 27
6. *Nectomys squamipes*
    a. *Ornithonyssus bacoti* 3
7. *Rhipdomys couesi*
    a. *Ornithonyssus bacoti* 1
8. *Rhipodmys leucodactylus*
    a. *Ornithonyssus bacoti* 1
9. *Rhipidomys macconnelli*
    a. *Ornithonyssus bacoti* 3
10. *Rhipidomys venezuelae*
    a. *Ornithonyssus bacoti* 2
11. *Thomasomys laniger*
    a. *Ornithonyssus* n. sp. 1
12. *Microxus bogotensis*
    a. *Ornithonyssus* n. sp. 1
13. *Akodon urichi*
    a. *Ornithonyssus* sp., nr. *bacoti* 1
    b. *Ornithonyssus bacoti* 3
14. *Zygodontomys brevicauda*
    a. *Ornithonyssus bacoti* 116
    b. *Ornithonyssus* sp. 2
    c. *Acanthonyssus proechimys* 1
    d. *Lepidodorsum tiptoni* 1
15. *Holochilus brasiliensis*
    a. *Ornithonyssus bacoti* 9
16. *Sigmodon hispidus*
    a. *Ornithonyssus bacoti* 100
    b. *Ornithonyssus* sp., nr. *bacoti* 1
    c. *Acanthonyssus proechimys* 1
17. *Sigmomys alstoni*
    a. *Ornithonyssus bacoti* 26
18. *Rattus rattus*
    a. *Acanthonyssus proechimys* 1
    b. *Ornithonyssus bacoti* 19
    c. *Ornithonyssus* sp., nr. *bacoti* 1

D. Family Dasyproctidae
1. *Agouti paca*
    a. *Ornithonyssus* sp., nr. *bacoti* 2

2. *Dasyprocta aguti*
   a. *Ornithonyssus bacoti* 1

E. Family Echimyidae
1. *Proechimys guyannensis*
   a. *Acanthonyssus proechimys* 10
   b. *Ornithonyssus bacoti* 13
2. *Proechimys semispinosus*
   a. *Acanthonyssus proechimys* 118
   b. *Ornithonyssus bacoti* 94
3. *Echimys semivillosus*
   a. *Ornithonyssus bacoti* 3

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